Vol. 84, No. 57, pp. 489–500 29 February 1972

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

FOUR NEW SPECIES OF TROGLOBITIC ASELLIDS (CRUSTACEA: ISOPODA) FROM THE UNITED STATES

By Laurence E. Fleming
Department of Biology
Virginia Polytechnic Institute and State University
Blacksburg, Va. 24061

The increase in the number of previously unknown species of North American troglobitic asellids that have been described in recent years furnishes the systematist with a more nearly adequate amount of material for the consideration of the evolution of both the epigean and the troglobitic nearctic asellid faunas. Such will be the objective of a subsequent paper; herein, are described four new species in partial preparation for that task. I am grateful to the following individuals for collecting this material and making it available to me: J. R. Holsinger, R. Norton, A. L. Metcalf, and T. D. Thornhill. I would like to thank Dr. Perry C. Holt for reviewing the manuscript.

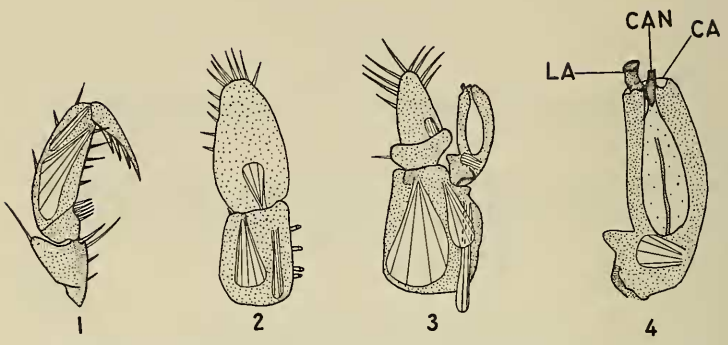
Asellus ancylus new species
Figures 1–4

Type-specimens: Holotype, USNM 135254; allotype, USNM 135255; 1 paratype, LEF 18–Y; taken from Brewer Cave, in mud bottom of stream, Boone County, Arkansas, by J. R. Holsinger, 26 June 1964.

Diagnosis: Small, albinistic, eyeless; holotype 4.6 mm in length, 1.0 mm in width; allotype (ovigerous) 4.1 mm in length, 1.2 mm in width (at brood pouch). Body slender, length approximately 4.6 times the width in holotype and 3.4 times the width in allotype.

Palmar margin of propodus of male gnathopod (peraeopod 1) without processes, but with 5 or 6 short, stout spines (Fig. 1). Opposable margin of dactyl without processes but armed with 3 or 4 long, stout spines.

Peduncle of first pleopod with 4 or 5 coupling hooks (Fig. 2). Exopod



Figs. 1–4. *Asellus ancylus.* 1. Mesial view of distal podomeres of left gnathopod. 2. Cephalic view of left first pleopod. 3. Cephalic view of left second pleopod. 4. Cephalic view of tip of endopodite of left second pleopod; LA = lateral process. CAN = cannula, CA = caudal process.

1.3 times longer than peduncle, 1.8 times longer than wide. Exopod narrows to obtuse apex. Slender setae distributed over lateral one-half to mesial one-fifth of exopod. Single small seta on laterodistal margin of peduncle.

Peduncle of male second pleopod 1.3 times longer than wide (Fig. 3). Exopod 0.75 times as long as peduncle; proximal segment bearing a single slender seta on lateral margin. Distal segment of exopod narrows apically to obtuse apex with long, slender setae on lateral one-half to mesial one-third of margin. Proximal part of endopod shorter than exopod with well-developed, triangular, lateral apophysis; reduced mesial apophysis. Distal part of endopod terminating in 3 processes (Fig. 4): (1) lateral process (LA) long, slender, projecting above other processes with apex cephalically recurvate forming a triangular structure with an acute tip proximally, (2) endopodial groove extended in the form of an apically projecting cannula (CAN) extending rectilinearly beyond caudal process to distal one-third of lateral process, and (3) caudal process (CA) forming a large, broadly rounded process lying behind cannula and lateral process.

Uropods absent in specimens collected.

Etymology: ancyl, Greek = crooked, bent, referring to the crooked, or recurvate shape of the lateral process of the male endopodial tip.

Variation: Only two variations were noted in the specimens studied: (1) in some specimens the mesial apophysis of the proximal part of the endopod is well-developed, and (2) in other specimens the proximal apex of the cephalically directed tip of the lateral process is not acute but rounded.

Affinities: *A. ancylus* is believed to have its closest affinities with

A. metcalfi (a new species described in this paper) and *A. spatulatus* (Mackin and Hubricht), 1940. All of the above species reveal affinities to each other through similarity in the anatomy of the endopodial tip of the male second pleopod. *A. ancylus* resembles the other two species in the shape of the cannula and the caudal process: the cannula in *A. ancylus* is straight, directed anteriad and extended beyond the tip of the endopod; the caudal process in *A. ancylus* is a large, broadly rounded process lying behind the cannula and lateral process. The cannula and the caudal process in the other two species are quite similar. The male gnathopod in *A. ancylus* resembles that of *A. metcalfi* in that it lacks processes, while the male gnathopod of *A. spatulatus* has at least two processes. The first pleopod in *A. ancylus* closely resembles the first pleopod in *A. metcalfi* and *A. spatulatus*. *A. ancylus* can be distinguished from *A. spatulatus* and *A. metcalfi* by use of the lateral process of the endopodial tip of the male second pleopod. The lateral process in *A. ancylus* is a long, slender structure projecting beyond the other processes with a cephalically recurvate apex. In the two other species the lateral process is about equal to or slightly shorter than the cannula and does not extend far beyond the endopodial tip.

Distribution: This species is known from a cave in Arkansas and a cave in Oklahoma and may be restricted to the central part of the United States.

Material Examined: Other than the type-locality, specimens of this species have been studied from: OKLAHOMA: Three Forks Cave on Gittin Down Mountain, Adair County, by Jeffery H. Black, 1 August 1970, 2♂♂.

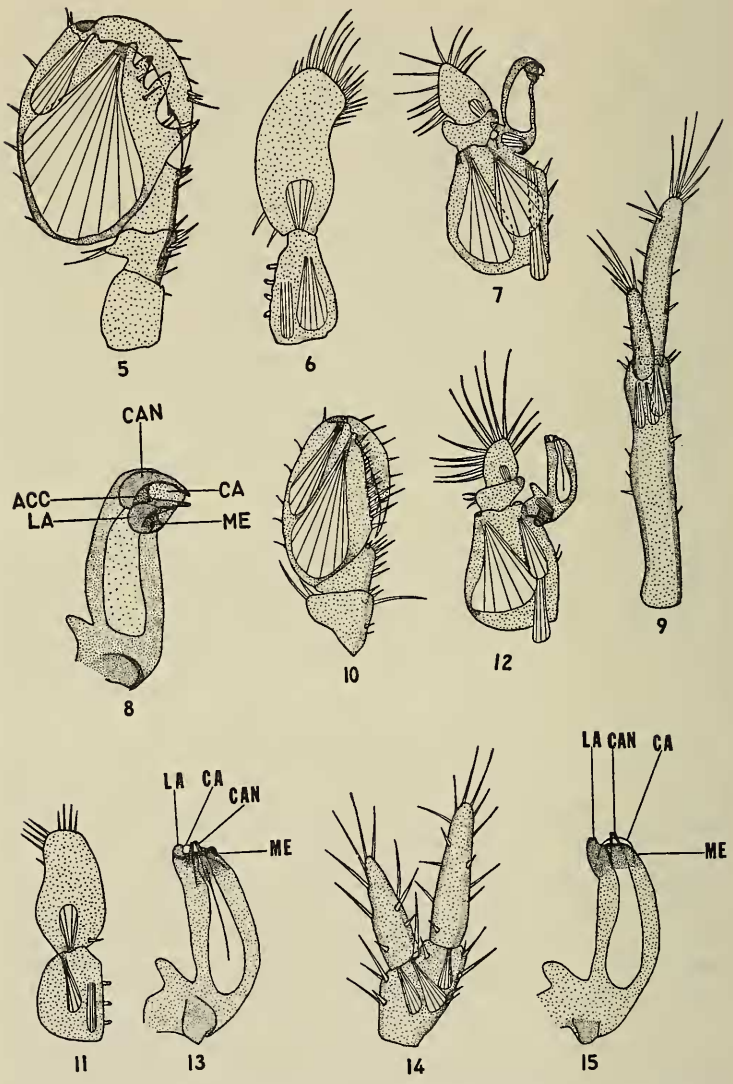
Asellus steevesi new species
Figures 5–9

Type-specimens: Holotype, USNM 135727; allotype, USNM 135728; 10 paratypes, LEF 28–G; taken from Carrico Cave, Dade County, Missouri, by J. Holsinger and R. Norton, 20 August 1968.

Diagnosis: Moderate sized, albinistic, eyeless; holotype 8.3 mm in length, 1.5 mm in width; largest male 10.5 mm in length; allotype 8.3 mm in length, 1.3 mm in width; largest female 10.1 mm in length. Body slender, length (excluding uropods) approximately 5.5 times the width in holotype and 6.3 times the width in allotype.

Palmar margin of propodus of male gnathopod (peraeopod 1) with 4 processes (Fig. 5): (1) proximal process, large with subacute apex, (2) two median processes short, subacute, conjointly located, and (3) distal process, small with obtuse apex. Proximal end of palmar margin with single robust spine on elevated, heavily sclerotized ridge. Opposable margin of dactyl without processes but armed with 3 or 4 small spines.

Peduncle of first pleopod with 4 to 6 coupling hooks (Fig. 6); peduncle triangular shaped, narrowing distally. Exopod 1.3 times longer



Figs. 5–9. *Asellus steevesi.* 5. Mesial view of distal podomeres of left gnathopod. 6. Caudal view of left first pleopod. 7. Cephalic view of left second pleopod. 8. Cephalic view of tip of endopodite of left second pleopod; LA = lateral process, ACC = accessory process, CAN = cannula, CA = caudal process, ME = mesial process. 9. Ventral view of left uropod.

than peduncle, approximately 2.0 times longer than wide. Exopod with lateroproximal margin convex, laterodistal margin concave; mesial margin convex; apex strongly directed laterad. Mesioproximal border of exopod bearing 2 setae directed obliquely posteriad. Apex of exopod covered with long, slender setae from mesial one-sixth to lateral one-fourth.

Peduncle of male second pleopod 1.3 times longer than wide with 3 stout setae and one small seta on mesiodistal border (Fig. 7). Exopod 0.63 times as long as peduncle. Distal segment of exopod ovate with long slender setae on entire lateral margin to distal one-third of mesial margin. Endopod equal to or slightly longer than exopod with well-developed, slender, lateral apophysis, much reduced mesial apophysis in proximal part; distal part of endopod with apex directed strongly mesiad perpendicular to mesial margin, terminating in 5 processes (Fig. 8): (1) mesial process (ME), small protuberance lying over lateral process, apex narrowing to obtuse tip, (2) lateral process (LA) large, rounded with 2 projections: proximal bluntly rounded projection and distal distinctly acute projection, (3) endopodial groove extended in form of large, rounded cannula (CAN) with 2 projections: proximal lanceolate projection extending beyond other processes and distal crescentic projection directed proximad, (4) caudal process (CA) broad, lying behind extended portions of other projections, and (5) accessory process (ACC) triangular, lying over rounded base of cannula.

Uropods (Fig. 9) of male with peduncle approximately 2.7 times longer than exopod. Endopod approximately 1.8 times longer than exopod. Both rami and peduncle sparsely covered with short setae. Apices of rami with many long, slender setae.

Etymology: This species is named in honor of Dr. Harrison R. Steeves III who has contributed so greatly to our knowledge of the troglobitic asellids of the United States.

Variation: The only variations worthy of mention are: (1) the two setae on the mesioproximal border of exopod of male first pleopod sometimes absent, and (2) the palmar margin of the propodus of the male gnathopod often without the two conjointed mesial processes.

Affinities: As presently understood, *A. steevesi* has no known close affinities with any of the previously described troglobitic asellids and must be regarded as a unique species.

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Figs. 10–15. *Asellus metcalfi*. 10. Mesial view of distal podomeres of left gnathopod. 11. Cephalic view of left first pleopod. 12. Cephalic view of left second pleopod. 13. Cephalic view of tip of endopodite of left second pleopod; LA = lateral process, CA = caudal process, CAN = cannula, ME = mesial process. 14. Ventral view of left uropod. 15. Cephalic view of tip of endopodite of left second pleopod of a paratype revealing a common form of variation.

Distribution: This species is known from a seep in Kansas, a cave in Missouri, and a cave in Oklahoma and is probably restricted to the central part of the United States.

Material Examined: Other than the type-locality, specimens of this species have been studied from: KANSAS: Seeps off of 7th Street in Baxter Springs, Cherokee County, by J. R. Holsinger, 12 June 1964. 9♂♂; 12♀♀. OKLAHOMA: Three Forks Cave on Gittin Down Mountain, Adair County, by Jeffrey H. Black, 1 August 1970. 7♂♂; 5♀♀.

Asellus metcalfi new species
Figures 10–15

Type-specimens: Holotype, USNM 135263; allotype, USNM 135264; 36 paratypes, LEF 33–W; taken from well about 30 feet west of A. C. Metcalf farmhouse about 8 miles southeast of Dexter, ¼ mile south, center, section 4T., 34S., R. 7E., Cowley County, Kansas, by Artie L. Metcalf.

Diagnosis: Small to moderate sized, albinistic and eyeless; holotype (largest male) 5.8 mm in length, 1.0 mm in width; allotype (largest female) 7.7 mm in length, 1.5 mm in width. Body slender, length (excluding uropods) approximately 5.8 times the width in holotype; approximately 5.1 times the length in allotype.

Palmar margin of propodus of male gnathopod (peraeopod 1) without processes but armed with many slender spines (Fig. 10). Opposable margin of dactyl without processes but armed with 2 or 3 short setae.

Peduncle of first pleopod with 3 coupling hooks (Fig. 11); mesial border rectilinear; lateral border convex. Exopod 1.4 times longer than peduncle, 1.8 times longer than wide. Exopod with single, short seta at proximal mesial border conjointed to peduncle; exopod convex proximally on lateral margin, concave distally on lateral margin, slightly narrowing to rounded apex, possessing long slender apical setae.

Peduncle of male second pleopod 1.3 times longer than wide with 2 short setae on mesiodistal margin (Fig. 12). Exopod approximately 0.58 times as long as peduncle; proximal segment with 3 or 4 slender setae on lateral border. Distal segment of exopod broadly rounded apically with long, slender setae on lateral margin to distal one-third of mesial margin. Endopod longer than exopod with well-developed slender, lateral apophysis, moderately-developed mesial apophysis in proximal part; distal part of endopod terminating in 4 distinct parts (Fig. 13): (1) lateral process (LA) short with broad heavily sclerotized base narrowing to fingerlike projection with rounded apex extending slightly beyond caudal process, (2) endopodial groove extended in form of stiff cannula (CAN) projecting slightly beyond the tip of the lateral process, (3) mesial process (ME) forming broad projection with slightly emarginate, heavily sclerotized apex reaching to base of lateral process and cannula, and (4) caudal process (CA) forming a wide, broadly rounded process lying behind other processes.

Uropods (Fig. 14) of male with peduncle approximately same length as or slightly shorter than exopod. Endopod approximately 1.3 times longer than exopod. Both rami and peduncle armed with long, slender setae on margins and apices of rami.

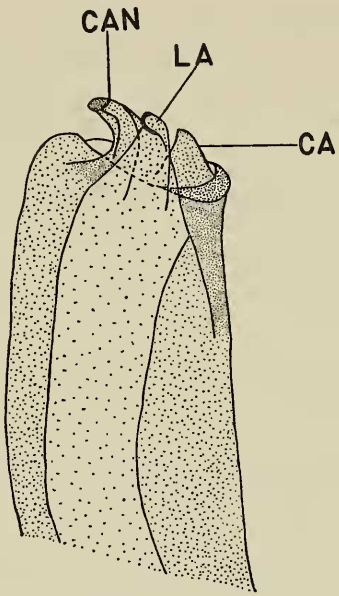
Etymology: This species is named in honor of Mr. A. C. Metcalf on whose property the well containing the isopods is located.

Variation: The endopodial tip of the male second pleopod reveals some variation from that of the holotype (Fig. 15). This form is very common among various specimens. It differs from that of the holotype primarily in the shape of the lateral process which is widely separated laterally from the other processes with the apex ending in a slightly rugose lobe. In some specimens the mesial process lies over and partially conceals the cannula.

Affinities: A. metcalfi exhibits a very close relationship to *A. spatulatus*. This relationship is indicated by the marked similarity between the endopods and endopodial tips of the second pleopod of the two species, as well as the close resemblance between the first pleopods of the two species. In *A. metcalfi* and *A. spatulatus* the first pleopod has a convex lateral border in the exopod and a single, slender seta on the proximal mesial border at the point of junction of exopod and peduncle. The general appearance of the male second pleopod in both species is quite similar in shape. The endopodial tip possesses 4 processes in both species which are similar: (1) a broad, platelike mesial process, (2) a stiff cannula projecting slightly beyond the tip of the lateral process, (3) a short fingerlike lateral process, and (4) a caudal process forming a wide, broadly rounded projection lying behind the other processes. *A. metcalfi* may be distinguished from *A. spatulatus* by the male gnathopod, male uropod, and lateral and mesial processes of the endopodial tip of the male second pleopod. The male gnathopod in *A. metcalfi* lacks processes on the palmar margin of the propodus, while *A. spatulatus* possesses at least two processes. The male uropod in *A. metcalfi* has the endopod and the exopod of approximately equal length, while the male uropod of *A. spatulatus* possesses an exopod much shorter than the endopod. The lateral process of the endopodial tip in *A. metcalfi* is fingerlike with a rounded apex and directed anteriad, while the lateral process in *A. spatulatus* is slender with an acute apex and is recurved mesially. The mesial process in *A. metcalfi* is a broad projection with a slightly emarginate, heavily sclerotized apex lying over the basal part of the cannula, while the mesial process in *A. spatulatus* is not quite as broad as that of *A. metcalfi* and lacks the heavily sclerotized apex. *A. metcalfi* also has close affinities with *A. ancylus*. It resembles *A. ancylus* in the shape of the endopod and endopodial tip of the male second pleopod. For details of the relationships of these two species see the affinities section in the description of *A. ancylus*.

Distribution: Known only from the type-locality.

Material Examined: Known only from the type-material.



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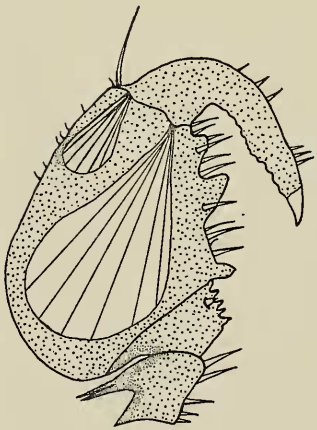

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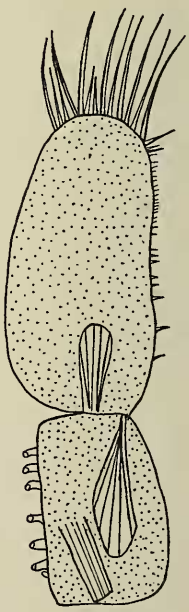

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Asellus paurotrigonus new species
Figures 16–20

Type-specimens: Holotype, USNM 135726; taken from ditch under Homochitto River bridge on U.S. 61 at Wilkinson–Adams County line, Adams County, Mississippi, by T. D. Thornhill, 1 March 1969.

Diagnosis: Large, albinistic, eyeless; holotype 16.7 mm in length, 2.8 mm in width. Body length (excluding uropods) 5.9 times the width.

Palmar margin of propodus of male gnathopod (peraeopod 1) with 3 processes (Fig. 16): (1) proximal process, small, short, narrowing to acuminate apex, obliquely directed posteriad, (2) mesial process, large with rounded apex, acutely directed anteriorly, and (3) distal process, small, short, with rounded apex. Opposable margin of dactyl without processes or spines, but with an undulating border.

Peduncle of first pleopod with 7 or 8 coupling hooks (Fig. 17). Exopod 1.5 times longer than peduncle, 2.0 times longer than wide. Exopod with mesial margin slightly convex, lateral margin slightly concave, bearing numerous setules along entire margin; apex rounded, bearing long setae confined to tip.

Peduncle of male second pleopod (Fig. 18) 1.6 times longer than wide with 4 long, stiff setae on mesiodistal margin. Exopod approximately 0.90 times as long as peduncle; proximal segment bearing 6 short setae on lateral margin. Distal segment of exopod slender, narrowing to subacute apex, bearing long, slender setae on entire lateral margin from mesiodistal one-fifth. Endopod shorter than exopod with well-developed mesial and lateral apophyses in proximal part; distal part of endopod terminating in 3 processes (Fig. 19): (1) caudal process (CA) extended from endopod tip, broad, roughly triangular in shape with flattened apex, (2) lateral process (LA) extended slightly beyond caudal process, broad, roughly triangular in shape, apex folded back upon itself with heavily sclerotized mesial margin, and (3) endopodial groove extended in the form of a broad, tubular cannula (CAN) slightly narrowing apically, extending beyond other processes and directed mesiad. Lateral margin of endopod apex with heavily sclerotized semicircular ridge enclosing caudal process.

Uropods (Fig. 20) of male with peduncle approximately 3.4 times longer than exopod. Endopod approximately 3.2 times longer than exopod. Both rami and peduncle covered with short setae. Apices of rami with many long, slender setae.

Etymology: pauro, Greek = small, trigon, Greek = triangle, referring

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Figs. 16–20. *Asellus paurotrigonus*. 16. Mesial view of distal podomeres of left gnathopod. 17. Caudal view of left first pleopod. 18. Caudal view of left second pleopod. 19. Caudal view of tip of endopodite of left second pleopod; CAN = cannula, LA = lateral process, CA = caudal process. 20. Dorsal view of left uropod.

to the shape of the caudal process of the male endopodial tip which resembles a small triangle.

Affinities: *A. paurotrigonus* has its closest affinities with two members of the Stygius Group, *A. stygius* (Packard), 1871, and *A. alabamensis* (Stafford), 1911. It resembles these two species in the shape of the uropods, armament of the male gnathopod and details of the endopodial tip of the male second pleopod. All three species have an enlarged, elongated endopod and a greatly shortened exopod of the male uropod. The three species have at least two large, prominent processes on the palmar margin of the male gnathopod. The endopodial tip of the male second pleopod reveals similarities among the three species in the cannula and caudal process: the caudal process of all three species is a prominent projection extended beyond the endopodial apex; the cannula in the three species is an elongated recurvate process. *A. paurotrigonus* differs from the other two species primarily in features of the endopodial tip of the male second pleopod. The lateral process in *A. paurotrigonus* is an enlarged, elongated process extending beyond the endopodial apex to approximately the same length as the other processes. The lateral process in *A. stygius* and *A. alabamensis* is a small, rounded projection not extended beyond the endopodial tip. Because of the above anatomical similarities of *A. paurotrigonus*, *A. stygius*, and *A. alabamensis* it is my opinion that *A. paurotrigonus* should be placed in the Stgyius Group of troglobitic asellids.

Distribution: Known only from the type-locality.

Material Examined: Known only from the holotype.

Remarks: This species exhibits most of the recognized characteristics of troglobitic isopods, such as: absence of body pigmentation and eyes, attenuation and elongation of appendages. Yet it was collected in a ditch in a locality without caves or a substrate in which caves might be formed.

There have been previous reports of troglobitic asellids from epigean habitats (Leonard and Ponder, 1949; Dexter, 1954, Minckley, 1961), but in all cases the animals were collected in the resurgents of cave streams, in springs, or in streams flowing over limestone in cavernous areas. The most probable explanation for the epigean occurrence of troglobitic animals is that put forth by Barr (1960) attributing their presence to accidental displacement. The feasibility of applying this explanation to the presence of *A. paurotrigonus* in an epigean habitat seems less likely due to the lack of nearby cavernous areas. Yet Holsinger (Personal Communication, April 1971) stated that the possibility for the occurrence of an "interstitial" species in the coastal plains area is very likely. He noted that for the amphipods this is a common place of habitation for certain species and specimens are often "washed" out by elevations in the water table such as occur during spring rains.

Nonetheless, the presence of this troglobitic animal in this epigean environment will remain an enigma until further collections of it are taken and their locations noted.

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